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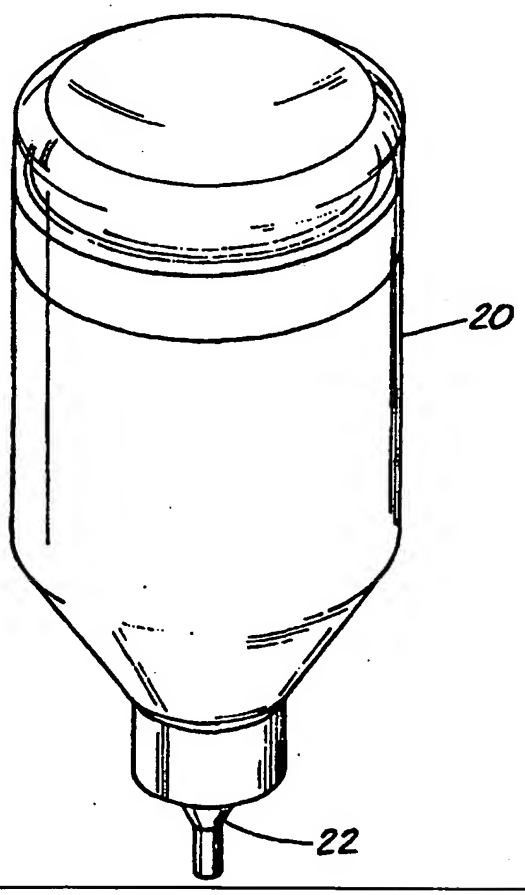
(54) Title: DISPENSING APPARATUS FOR FOAMING COMPOSITIONS AND METHOD

(57) Abstract

An apparatus (80) for dispensing a foamable fluid composition (81) includes a sealed container (82) for the composition and an enclosure (100) which is supported by the container and openable to the container such that a constituent (83) isolated in the enclosure prior to use may be released in the container to produce gas pressure for dispensing. A method for preparing a pressurized container for dispensing a foamable fluid composition includes adding to the composition, before use, a constituent reactable with the composition to provide pressurized gas for dispensing. Rupturing a frangible wall (102) which forms at least a portion of the enclosure is highly preferred.



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Title: DISPENSING APPARATUS FOR FOAMING COMPOSITIONS AND METHOD

Field of the Invention

This invention is related generally to dispensing and, more particularly, to dispensing a fluid product from a pressurized container. Still more particularly, the invention is related to dispensing of foaming fluid compositions.

Background of the Invention

The invention described and claimed herein is useful in dispensing a wide variety of fluid compositions. Important among such compositions are fluid soaps and cleaning products, and because of this some information concerning soap products may be useful background.

Conventional personal care and household and industrial cleaning products are available in solid, powder, liquid, gel and cream form. The most common and familiar personal care and cleaning products on the market today are in the form of bar soaps, which produce a lather or foam by agitation with the hands and body or

surface to be cleaned. Bar soaps come in a variety of types and are relatively inexpensive.

One of the most common problems associated with bar soaps is the difficulty in "working up" a lather from the bar for spreading. Considerable time and dexterity are usually required. Another problem associated with bar soaps is the inability to maintain sanitary conditions while exposing the bar to multiple uses and multiple users. While personal hygiene is just that -- personal, a bar of soap is considered a "community object."

An additional problem associated with bar soaps is maintaining them in a fresh, appealing condition. Soap bars sit in soap dishes and are exposed to moisture where they tend to break down into an unsightly gelatinous state. Additionally, bar soaps tend to cause unsightly residue or "scum" on sink, bath tub and shower surfaces if exposed to water.

In an effort to overcome some of these problems, the industry developed liquid cleaning and personal care products. These products are generally available as thick liquids, such as shampoos, conditioners, shower gels, liquid soaps and cleaners. These products are relatively slow-foaming and they usually produce very little, relatively weak foams which quickly flatten. Additionally, to maintain acceptable levels of foam, repeated use of the products in one grooming or cleaning session is often required. Furthermore, many of these liquid or gel products are subject to the drip or drool factor, whereby, after dispensing, a portion of the substance remains in the valve of the container and tends to drool after time, leaving an unsightly mess on dispensers as well as on sink, counter and shower surfaces.

Post-foaming gel compositions and foaming compositions were developed in an effort to overcome some of the shortcomings of bar and liquid products. These compositions are typically dispensed from aerosol or

barrier packages/containers. In the case of a post-foaming gel, when the gel is spread over the skin, hair or other surface and rubbed, the gel post-foams into a lathered product. One disadvantage associated with these products is that, when the compositions are dispensed in the form of a stable gel, the gel is not easily spread over the surface to be treated or cleaned in an even and fluid manner. Rather, these post-foaming gel compositions tend to clump and fall off the surface to be cleaned, particularly surfaces that are not horizontal. Further, products dispensed as foams from an aerosol package are either too wet and runny with limited foam stability, or too stiff and dry, neither of which provides the essential pleasing feel or texture.

Additionally, both the post-foaming gel and foam products are generally packaged in rigid pressurized aerosol containers or barrier packages with hydrocarbon propellent gases contained therein. Such containers or packages are expensive to manufacture and ship. Further, the propellants used often do not form an integral part of the composition and are typically compartmentalized from the product to provide the positive pressure needed to aid in the dispensing of the product. Such containers are known in the industry as barrier packages because they provide a barrier between the propellants and the composition to be dispensed.

The propellent gases eventually released to the atmosphere by use of these containers have increasingly come under attack as environmentally unacceptable. Many of the commonly used propellants are believed to cause degradation of the ozone layer of the earth.

Further, in recent years, there has been a movement toward recycling and reusing containers in an effort to reduce the need for landfill space. This is evidenced by the great number of communities that now have voluntary or mandatory recycling programs. In appreciation of this, many manufacturers of products now provide for

recyclable containers or reusable containers which can be repeatedly refilled. Unfortunately, the containers currently used to dispense foamable and post-foamable products are not readily reusable or recyclable.

The above-noted prior art products suffer from various deficiencies. However, one of the greatest deficiencies is lack of foam or difficulty in obtaining and maintaining adequate foam levels during use. In personal care and household and industrial cleaning, foam and foam stability are associated with cleaning ability. The consumer equates a greater foam level with better cleaning ability.

An additional disadvantage associated with the prior art products discussed above is that many of such containers are not particularly aesthetically appealing. Consumers are attracted to sleek, clear, lightweight packaging to which an attractive label can be applied, and there is a need for improved aesthetic possibilities in containers for foamable and post-foamable products.

Further, prior art containers are not manufactured to withstand use in high moisture areas. Many prior art containers begin to rust when repeatedly exposed to moisture. Thus, such containers will not withstand long periods in the shower or bath without beginning to rust and mar surfaces.

Although clear plastic containers are desirable because of the advantages of easier recyclability, their attractive clear appearance, their reduced weight and elimination of moisture susceptibility, several concerns are raised in using such plastic containers. Often the contents of such containers are maintained under pressure to provide for dispensing and initial foam. However, this raises concerns about shelf life of the product because of permeation of compressed gases through the walls of such plastic containers.

Additionally, concerns arise with regard to the transportation of such containers. Many foamable and

post-foamable compositions include a wide range of potentially flammable constituents in varying amounts. With the introduction of pressure to such compositions and containers, safety issues arise. Several government agencies regulate the transport of such products, and compliance with such regulations is often difficult and costly.

Therefore, it would be an improvement in the art to provide a container or package that can be used to dispense a composition that readily produces rich foam or lather and maintains suitable foam levels during the cleansing process, that does not require harmful propellants, and that is easily reusable or recyclable. Additionally, a container for such compositions which is aesthetically pleasing, lightweight and resistant to moisture would be an improvement. Furthermore, avoiding the permeation and resulting shelf-life problems and transportation concerns and regulations related to use of plastic containers for such compositions would be an very significant improvement in the art.

In summary, there is a clear need for improved compositions and dispensing systems overcoming or alleviating the above-noted problems. With respect to soap products, while the bar soaps of the prior art are cheap and convenient they are lacking in hygiene and sanitation as well as foam production and maintenance. Although the liquid, gel and foam products of the prior art provide for more convenience and sanitation, they lack the optimum foam-producing and foam-maintaining capabilities and spreadability desired in such personal care and cleaning compositions.

Furthermore, such liquid, gel and foam compositions often prove difficult and expensive to package and dispense. And, existing packages or containers raise various environmental concerns, and all of these factors further increase overall costs.

There is an ongoing search for improved compositions and dispensing packages for such soap products and for a variety of other foamable or post-foamable products.

Objects of the Invention

It is an object of this invention to provide improved apparatus for dispensing a fluid composition, particularly foamable compositions, which overcomes some of the problems and shortcomings of the prior art.

Another object of this invention is to provide personal care and cleaning compositions which produce adequate initial foam and maintain foam levels during cleaning.

A further object of the invention is to provide a composition that can be used multiple times by multiple users while maintaining sanitary conditions.

Another object of this invention is to provide a dispensing container for such compositions which can be made aesthetically pleasing and which is light in weight.

An additional object of the invention is to provide a package for such compositions which is less susceptible to problems from the presence of moisture.

A further object of this invention is to provide a plastic dispensing container which overcomes gas permeation problems and resulting shelf-life concerns.

Still another object of this invention is to provide an apparatus incorporating a mechanism whereby a constituent can be discharged into a container to prepare a foamable composition for dispensing.

Still another object of the invention is to provide a method for preparing a pressurized container for dispensing a fluid composition.

These and other important objects will be apparent from the following description and from the drawings.

Summary of the Invention

This invention is improved apparatus for dispensing a fluid composition, particularly a foamable fluid composition, and a method for preparing a pressurized container for dispensing such a fluid composition. The apparatus and method of this invention overcome certain well-known problems and deficiencies of the prior art, including those outlined above.

An important aspect of this invention is the provision of an apparatus which allows for quick, easy and environmentally-superior preparation and use of foamable compositions. The invention allows use of a plastic package without gas permeation problems and the related shelf-life concerns.

The novel apparatus of the present invention includes a sealed container for the composition to be dispensed and an enclosure supported by the container. Such an enclosure is openable to the container, thus allowing a constituent isolated in the enclosure to be released within the container prior to dispensing the composition. In preferred embodiments, at least a portion of the enclosure is within the sealed container.

The constituent thus released into the container reacts with a portion of the composition in the sealed container to produce gas for dispensing. The constituent may be a solid, e.g., in a tablet, powder or granular form, a gel or a liquid. It is only necessary that such constituent be capable of reacting in the sealed container to produce gas.

In certain highly preferred embodiments, the container has an opening and the enclosure is secured to the container at the opening thereby sealing the container. In this embodiment, the enclosure is preferably formed at least in part by a frangible wall, whereby rupturing of the wall releases the constituent.

Highly preferred embodiments having such a frangible wall further include a rupturing member secured with respect to the container. The rupturing member and the

frangible wall are preferably movable relative to one another, thereby enabling rupturing of the wall. In one preferred embodiment, the rupturing member includes a projection positioned to engage the frangible wall.

In certain preferred embodiments, the rupturing member further includes a stem movably secured with respect to the container. The stem preferably also provides and defines a discharge path for dispensing of the composition.

In certain preferred embodiments, the rupturing member is rotatably mounted. In certain others, the rupturing member is mounted for linear movement.

The method of this invention, which involves preparing a pressurized container for dispensing a foamable fluid composition, includes providing a sealed container containing a foamable composition, and adding to the composition a constituent reactable with the composition to provide pressurized gas in the sealed container for dispensing the composition.

Certain highly preferred examples of the method of this invention involve use of an enclosure which is supported by the sealed container and contains the constituent, at least a portion of such enclosure being a frangible wall within the sealed container. In such preferred forms examples of the method of this invention, the adding step includes rupturing the frangible wall to release the constituent into the container. This is preferably accomplished by moving a rupturing member, which is secured with respect to the container, with respect to the frangible wall until the wall is ruptured.

In certain preferred forms of this inventive method, the moving step includes imparting relative rotation between the rupturing member and the frangible wall. In other preferred forms, the moving step includes imparting relative linear movement between the rupturing member and the frangible wall.

A great many variations in such apparatus and method are possible without departing from the scope of the invention. For example, the constituent-containing enclosure which is supported by the container may be in various places, such as in a cap or cover beyond the boundary of the pressurized seal, or even in an external wall-mounted location. In such cases, the sealed container for the composition to be dispensed is temporarily opened to allow the previously-isolated constituent to be added, and then the container is resealed. Such opening and resealing of the sealed container may be by means of a screw cap, which preferably also includes a valve and any other related dispensing devices.

Brief Description of the Drawings

FIGURE 1 is a perspective view of an exemplary apparatus for dispensing a foamable composition used for bathing.

FIGURE 2 is a side sectional view of the container of FIGURE 1.

FIGURE 3 is a side sectional view of an alternative embodiment.

FIGURE 4 is a an enlarged fragmentary view of the mechanism of FIGURE 3.

FIGURE 5 is an enlarged fragmentary view of an alternative mechanism.

FIGURE 6 is an enlarged fragmentary view of another alternative mechanism.

FIGURE 7 is fragmentary side sectional view of still another embodiment of this invention.

FIGURE 7A is a sectional view taken along section 7A-7A as indicated in FIGURE 7.

FIGURE 8 is a side elevation of yet another embodiment of the invention.

FIGURE 9 is a fragmentary side sectional view of a further embodiment of this invention.

Detailed Descriptions of the Preferred Embodiments

Prior to a discussion of the apparatus and method of this invention, it should be noted that the term "foamable" as used herein refers to compositions which are foam upon dispensing, and compositions which are dispensed as a liquid or gel and then post-foam, and compositions which are dispensed as a foam which then post-foam.

Compositions to which the apparatus and method of this invention are directed typically include foamable utilitarian formulations. Such formulations typically incorporate surfactant systems and may also incorporate a post-foaming agent. Diluents and other ingredients are also typically included. Such foamable compositions utilize a compressed gas to provide adequate pressure for dispensing from a sealed container. Additionally, such compressed gas may provide foaming of the composition upon dispensing.

Suitable surfactants, post-foaming agents, and other ingredients are well know to those skilled in the art.

The compressed gas in this invention is provided by a gas-producing substance which before use is isolated (in an enclosure) to protect it from exposure to moisture and to allow storage of the foamable composition in plastic containers without the compressed gas, thereby avoiding gas permeation problems. Such gas-producing substance (or "constituent") can be in the form of a liquid, gel or solid. Preferably, the gas-producing substance is an effervescing tablet or powder of sodium bicarbonate and citric acid or of sodium bicarbonate and sodium citrate. When such constituent is released into the composition within the container, the combination of water in the composition and the released constituent results in a gas-producing reaction. Such reaction in the sealed container provides pressure for dispensing.

FIGURE 1 illustrates a dispensing apparatus 80 in an inverted orientation ready for dispensing of a foamable

composition 81. As seen in FIGURE 2, apparatus 80 includes a container 82 and a mechanism 84 whereby a constituent 83, in the form of granules, is isolated from composition 81 and ready for release within container 82 prior to dispensing the composition.

Container 82 includes a valve 86. Valve 86 has a hollow stem 88 and a resilient stem retainer 90. Stem 88 includes a valving member 92 (forming a portion thereof) and radial inlet passages 95a in communication with an axial flow passage 95b to define a discharge path through the stem. Valving member 92 includes an elongated portion 93 and a head portion 94, allowing it to function as a dispensing valve upon tilting or depression of stem 88, in known fashion.

Container 82 is of a barrier material to minimize loss of pressure by gas permeation. Suitable materials are barrier plastic materials, metal, glass, or a metal-coated plastic material or laminated material. A preferred material for container 82 is polyethylene-terepthalate (PET). Container 82 is preferably translucent or transparent. Container 82 can be permanently sealed or can include a removable cap 96. Additionally, the apparatus can include a cover 98 as shown in FIGURE 7.

Mechanism 84 includes an enclosure 100 which is supported by the container and is openable to the container. Enclosure 100 includes a frangible wall 102, hereafter described. The enclosure can be formed of a foil, foil laminate, plastic laminate, plastic or other suitable material known to one of ordinary skill in the art. Mechanism 84 further includes a rupturing member 104, which includes the aforementioned stem 88.

In the embodiment of FIGURE 2, enclosure 100 is cone-like in shape with the point of the cone being flat in frusto-conical fashion. Frangible wall 102 is disposed at the flat tip of the cone. In preferred embodiments, the enclosure 100 is formed of a plastic

material and a foil laminate is disposed over an aperture at the flat tip of the cone. The sides of the enclosure preferably extend upwardly at approximately the same angle. Enclosure 100 is secured to container 82 by a horizontally disposed lip 105 that extends around the edge of the enclosure. Lip 105 is positioned between the lip of container 82 and cap 96 to provide a seal. In the embodiment shown in FIGURES 3 and 4, enclosure 100 has a curved upper edge 106 adapted to enclose the edge of the valve plate 107.

In the embodiments shown in FIGURES 2, 3 and 4, rupturing member 104 includes stem 88, its valving member 92, and an extension member 106 attached to head portion 94. Such an arrangement results in extension member 106 and stem 88 being coupled to one another. In this embodiment, extension member 106 and stem 88 are coaxially aligned with respect to one another.

In use, container 82 of FIGURES 2, 3 and 4 includes composition 81 except for gas-producing constituent 83 which is disposed in enclosure 100, isolated from composition 81. Downward pressure is exerted on stem 88 thereby causing extension member 106 to exert a force on frangible wall 102 of enclosure 100, rupturing such frangible wall. Thus, gas-producing constituent 83 is released within container 82, such action occurring without ever opening container 82 or disrupting the integrity of its sealed condition, other than such brief opening as may result from depression of valve stem 88. It should be noted that any such brief opening does not appreciably interfere with pressure build-up.

Container 82 is agitated to mix the gas-producing constituent into the composition creating pressure inside container 82. In use, container 82 is inverted and valve 86 is used to dispense the foamable composition.

In the alternative embodiment shown in FIGURE 5, enclosure 100 is cone-like in shape, with one side of the enclosure having a steeper angle of incline than the

other side. Frangible wall 102 is on the side having the steeper angle of incline. Extension member 106 and stem 88 are offset with respect to one another. An attachment piece (projection) 120 extends through frangible wall 102 and into extension member 106. In use, container 82 includes composition 81 except for the gas-producing constituent which is disposed in enclosure 100 where it is isolated from the foamable composition. Stem 88 is rotated to cause offset extension member 106 to rotate rupturing frangible wall 102 and thereby release the gas-producing constituent into the container. Container 82 is then agitated as previously discussed, and when inverted utilizes valve 86 for dispensing the composition. With this embodiment, release of the gas-producing constituent is accomplished without ever interrupting the sealed condition of container 82.

In the embodiment shown in FIGURE 6, enclosure 100 again is cone-like in shape, with one side of the enclosure having a steeper angle of incline than the other side and with the cone terminating in a flat tip. In this case, however, enclosure 100 includes frangible wall 102 at the tip thereof. As above, stem 88 is offset with respect to the extension member and attachment piece (projection) 120 extends through frangible wall 102 and into extension member 106.

As above, stem 88 is rotated thereby rotating extension member 106 and rupturing frangible wall 102. The gas-producing constituent is released into container 82 and the previously discussed steps are followed.

In the embodiment shown in FIGURE 7, a projection 125 has triangular-shaped teeth disposed in container 82. As shown in FIGURE 7A, projection 125 has a circumference that is oval in shape. Such apparatus further includes a cover 98 with enclosure 100 disposed therein. A suitable laminate is disposed over enclosure 100 to provide a frangible wall 102.

In use, cover 98 is removed. Cap 96 is then also removed (by unscrewing) along with valve 86. Cover 98 is placed over the top of container 82 such that projection 125 is aligned with frangible wall 102. Downward pressure is exerted along with rotation of cover 98 relative to the container, thereby rupturing wall 102 and releasing the gas-producing constituent into container 82. Cover 98 is then removed and cap 96 is again secured to the container. Agitation, inversion and dispensing proceed as above.

In the embodiment shown in FIGURE 8, a packet or other suitable enclosure 100 is affixed to the exterior of container 82. A gas-producing constituent is provided in such enclosure 100. In use, cap 96 is removed, the enclosure is ruptured to open it, and the gas-producing constituent is poured, dropped or released into the container along with a post-foamable composition. Cap 96 is then secured to container 82 and agitation, inversion and dispensing occur as above.

In the embodiment of FIGURE 9, rupturing member 104 includes a pointed or sharp extension member 106 attached to head portion 94 of the valving member. Stem 88 can be aligned or offset with respect to extension member 106. In use, depending on the positioning of extension member 106, stem 88 is either depressed or rotated to effectuate rupture of enclosure 100 and release of the gas-producing constituent into container 82.

While a number of the embodiments illustrated and discussed had enclosures with frangible walls, other embodiments of this invention can utilize enclosures which are openable in ways other than rupturing. For example, the enclosure can include relatively rotatable members the rotation of which will cause alignment of apertures to allow release of a gas-producing constituent. A number of other mechanical operations not involving rupturing, or including more than rupturing,

can be used. Some of these involve the opening of orifices by sliding or swinging mechanisms.

In any of the above embodiments, to simplify and assist in either the depression or rotation of stem 88 to rupture the enclosure, a mating sleeve (not shown) can be secured over stem 88 in a position outside container 82. Such a sleeve can be used to more easily grasp and manipulate the relatively thin stem. This sleeve could then be removed and discarded.

One example of a post-foamable composition suitable for use with this invention is set forth below. Such example represents a composition after release of the gas-producing constituent into the container. All of the percentages are weight percentages.

CONSTITUENT	%
Carbopol ETD 2020 (thickener)	0.88
Plantaren PS300 Ammonium Lauryl Sulfate, Decyl Polyglucose	12.50
Polysorbate-20 (viscosity modifier)	5.00
Triethanolamine (TEA) -(alkali to neutralize Carbopol)	0.05
Ammonium Lauryl Sulfate	15.00
Isobutane	2.00
Isopentane	2.50
Water	60.32
Sodium Bicarbonate, Sodium Citrate	1.75

*****

This composition is a post-foamable foam composition suitable for use as a hand and body cleanser suitable for use in the shower.

While the principles of this invention have been described in connection with specific embodiments, it should be understood clearly that these descriptions are made only by way of example and are not intended to limit the scope of the invention.

WHAT IS CLAIMED:

1. An apparatus for dispensing a fluid composition, the apparatus including:

-a sealed container for the composition to be dispensed; and

-an enclosure supported by the container and openable to the container;

whereby a constituent isolated in the enclosure may be released within the container prior to dispensing the composition.

2. The apparatus of claim 1 wherein at least a portion of the enclosure is within the sealed container.

3. The apparatus of claim 2 wherein the container has an opening and the enclosure is secured to the container at the opening thereby to seal the container.

4. The apparatus of claim 3 wherein the enclosure is formed at least in part by a frangible wall, whereby rupturing of the wall releases the constituent.

5. The apparatus of claim 4 further including a rupturing member secured with respect to the container, the rupturing member and the frangible wall being relatively movable for rupturing the wall.

6. The apparatus of claim 5 wherein the rupturing member includes a projection positioned to engage the frangible wall.

7. The apparatus of claim 6 wherein the rupturing member is rotatably mounted.

8. The apparatus of claim 6 wherein the rupturing member is mounted for linear movement.

9. The apparatus of claim 5 wherein the rupturing member includes a stem movably secured with respect to the container, the stem defining a discharge path for dispensing of the composition.

10. The apparatus of claim 9 wherein the stem is rotatably mounted.

11. The apparatus of claim 9 wherein the stem is mounted for linear movement.

12. The apparatus of claim 1 wherein the enclosure is formed at least in part by a frangible wall, whereby rupturing of the wall releases the constituent.

13. The apparatus of claim 12 further including a rupturing member secured with respect to the container, the rupturing member and the frangible wall being relatively movable for rupturing the wall.

14. The apparatus of claim 13 wherein the rupturing member includes a projection positioned to engage the frangible wall.

15. The apparatus of claim 14 wherein the rupturing member is rotatably mounted.

16. The apparatus of claim 14 wherein the rupturing member is mounted for axial movement.

17. The apparatus of claim 13 wherein the rupturing member includes a stem movably secured with respect to the container, the stem defining a discharge path for dispensing of the composition.

18. The apparatus of claim 17 wherein the stem is rotatably mounted.

19. The apparatus of claim 17 wherein the stem is mounted for axial movement.

20. A method for preparing a pressurized container for dispensing a fluid composition, the method including:

-providing a sealed container containing a foamable composition; and

-adding to the composition a constituent reactable with the composition to provide pressurized gas in the sealed container for dispensing the composition.

21. The method of claim 20 wherein an enclosure containing the constituent is supported by the sealed container, at least a portion of the enclosure being within the sealed container and having a frangible wall, and wherein the adding step includes rupturing the frangible wall to release the constituent into the container.

22. The method of claim 21 wherein a rupturing member is secured with respect to the container and wherein the rupturing step includes moving the rupturing member with respect to the frangible wall to rupture the wall.

23. The method of claim 22 wherein the moving step includes imparting relative rotation between the rupturing member and the frangible wall.

24. The method of claim 22 wherein the moving step includes imparting relative linear movement between the rupturing member and the frangible wall.

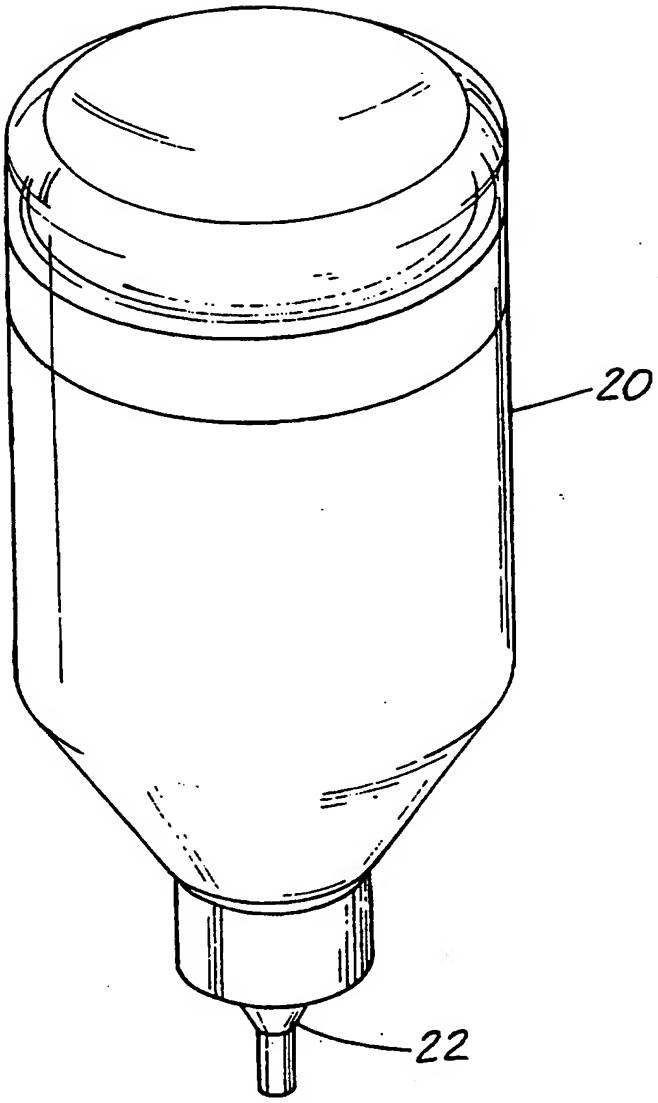

FIG. 1

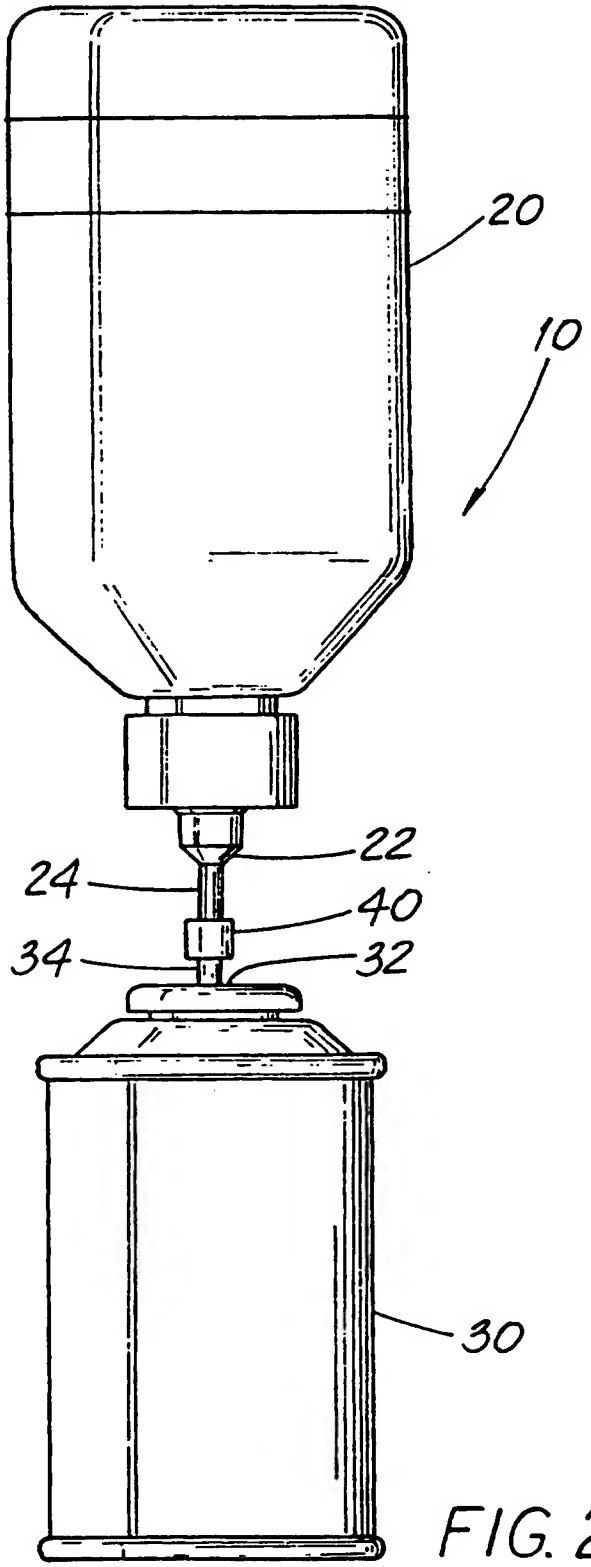

FIG. 2

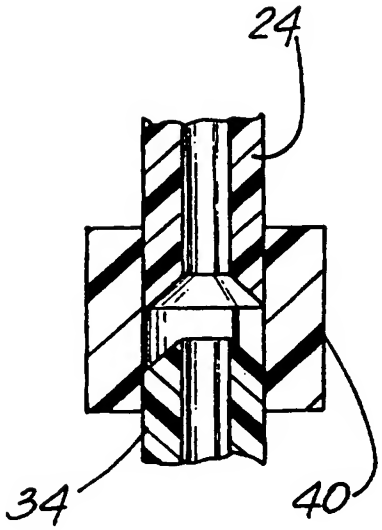

FIG. 3

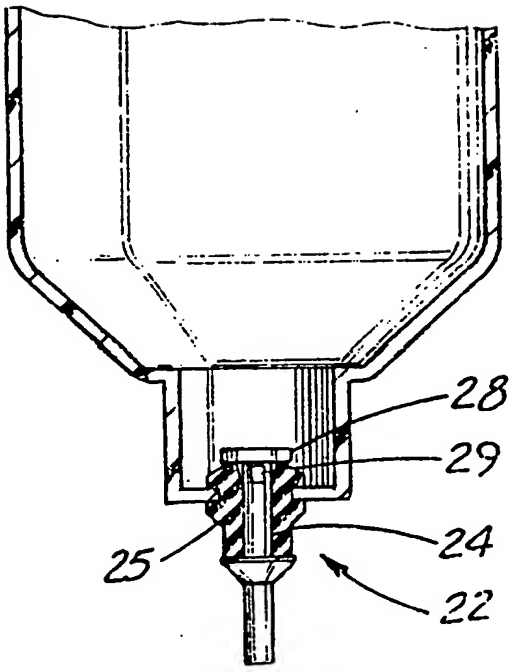

FIG. 4

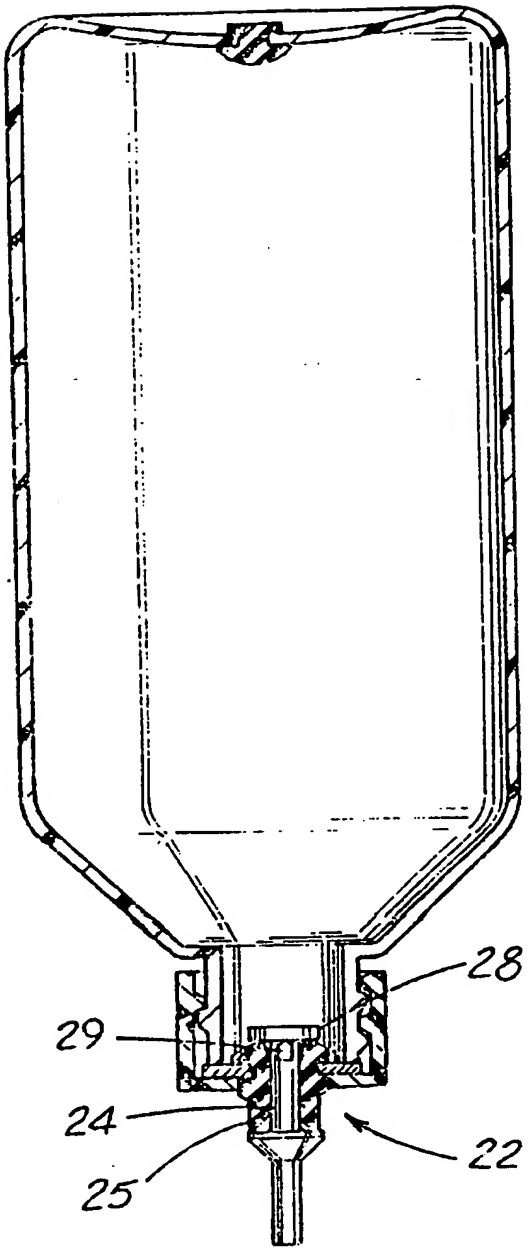

FIG. 5

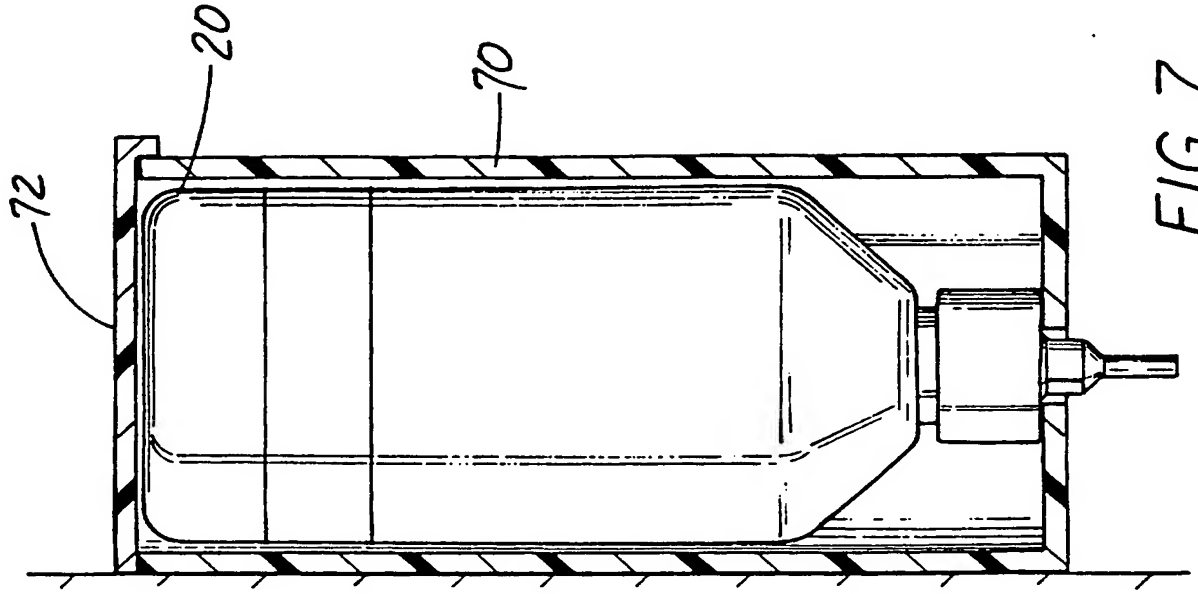

FIG. 7

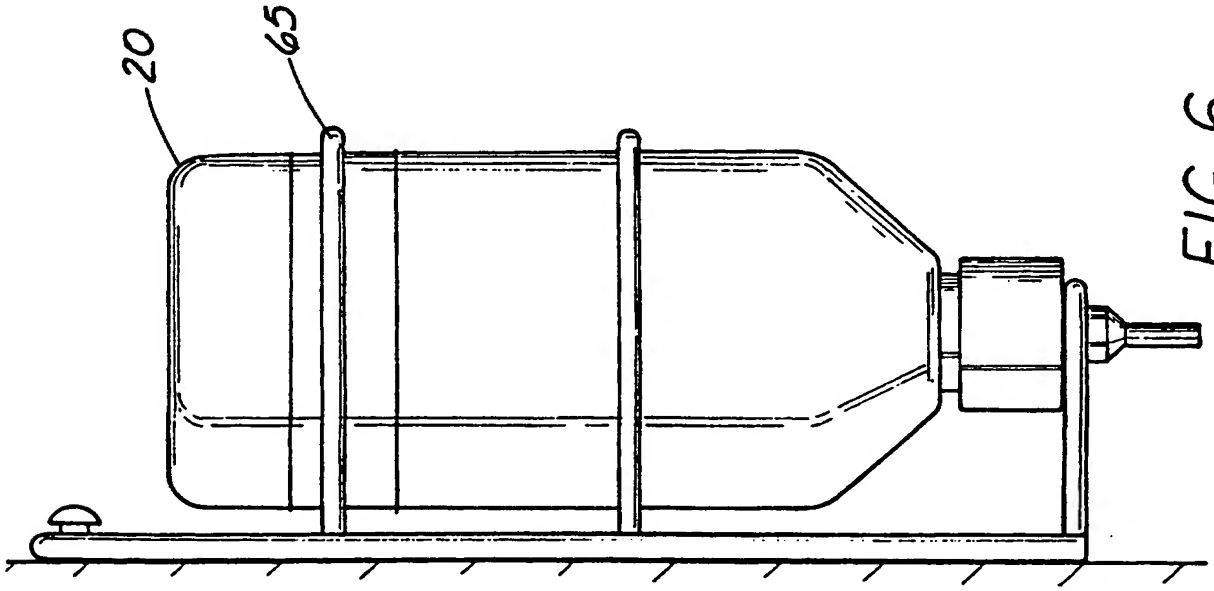

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/13437

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B67D 5/00
US CL :222/001, 080, 386.5, 394

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 222/001, 080, 083, 386.5, 394

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US, A, 4,177,938 (Brina) 11 December 1979, see entire document.	1-7,9,10,12-15,17,18 --- 8, 11, 16, 19, 22-24
X --- Y	US, A, 5,234,140 (Demarest et al.) 10 August 1993, see entire document.	20, 21 --- 22-24
Y	US, A, 3,347,410 (Schwartzman) 17 October 1967, see entire document.	8, 11, 16, 19, 24
A	US, A, 3,354,883 (Southerland) 28 November 1967.	-
A	US, A, 3,874,557 (Porter) 01 April 1975.	-

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 27 DECEMBER 1995	Date of mailing of the international search report 24 JAN 1996
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer JOSEPH A. KAUFMAN Telephone No. (703) 308-1113

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/13437

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,923,095 (Dorfman et al.) 08 May 1990.	

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